

Science Collaborative Progress Report for the Period 03/01/12 through 08/31/12

Project Title: Determining the role of estuarine 'swashes' on water quality impairment along the Grand Strand of South Carolina: Impacts of land use and stormwater runoff.

Principal Investigator(s): Dr. Erik M. Smith

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Report compiled by: Dr. Erik M. Smith

Contributing team members and their role in the project:

M. Richard DeVoe – Integration Co-lead

Dr. Denise M. Sanger – Integration Co-lead

Leigh Wood – Local Outreach Facilitation

Dr. Susan Libes – Research Co-PI

Dr. Richard Viso – Research Co-PI

Dr. Richard Peterson – Research Co-PI

Dr. Jennifer Plunket – Research Co-PI

A. Progress overview: The overall project goal is to address how land use attributes and stormwater management practices and conveyance within swash watersheds affect nutrient and organic matter loading to those swashes, their internal transformations, and subsequent export to the coastal ocean. The ultimate intent is to enable effective management strategies, based on sound science, that improve and protect coastal water quality, particularly with respect to hypoxia, in Long Bay. To do so, the following key project objectives have been identified: 1) Work with intended users to define and develop a categorization scheme for all 14 swashes and select 4 swashes for intensive investigation during the proposed study; 2) Quantify concentrations and forms of nutrient and organic matter entering swashes via surface water and groundwater inputs; 3) Determine internal conditions and processes affecting organic matter transport and transformations in swashes; 4) Quantify the form and net tidal export of nutrients and organic matter from swashes; 5) Engage intended users to enable use of data to collaboratively develop science-based cost-effective management strategies.

To accomplish the above project goal, our intention during this reporting period was to continue sampling the two swashes selected for study in Year 1 and work with the communities in the two existing swash locations as well as host the third workshop to identify the Year 2 swash locations. The 2 swashes chosen for Year 1 sampling are Withers Swash in Myrtle Beach and Dogwood Swash in Surfside Beach. The third workshop with the research team and intended users determined that additional data should be collected in the same two swashes instead of moving to two new swashes. The group also discussed how additional outreach efforts could be focused in the swashes that were not being studied. Data collection and sample processing for both swashes is currently ongoing.

B. Working with Intended Users: Maintaining a strong relationship with participating municipalities is a key success component to the NERRS Science Collaborative Swash Project, especially since the results are intended to eventually help inform planning and engineering solutions. Since the beginning of the project, local decision-makers, coastal resource managers, and researchers have been brought together to help define the problem and assist with project implementation.

The third workshop for the full research and intended user team was held on June 27, 2012. All but three of the intended users were present for the workshop. The workshop involved: (1) a quick overview of the project goal and previous workshops; (2) summary presentation and discussion of the preliminary sampling results to date; and (3) discussion and a decision of year

2 sampling. The following three options were presented for discussion regarding the year 2 swashes for sampling: (1) stay in the same two swashes as proposed by an intended user at the second workshop; (2) move to two new swashes as proposed in the proposal; or (2) stay in one swash and move to one new swash. This discussion included the research team and intended users providing input on the pros and cons to each of the options. After an interesting discussion of the options, the group decided that the research team should remain in the two swashes they are currently sampling. The group decided that the two swashes were representative and the information transferable to the other swashes. There was agreement that more data at fewer sites was better than less data at more sites.

The group discussed insuring that the outreach was broader than only the two study swashes, particularly now that they would be sampled in year 2. The group suggested that outreach to North Myrtle Beach was critical as the information was transferable. Suggestions for the outreach included using lots of pictures to show how applicable and how the generalized principals of swashes geographic presentation could be developed and used to give tours and other outreach opportunities in some of the higher density areas. In addition, a booklet/two pager was suggested on swashes and what they do. This could be used by the larger programs targeted at educating on what a swash is for and what it does.

The Coastal Training Program and the Coastal Waccamaw Stormwater Education Consortium are partnering to host an education program for local officials, staff, and community leaders on November 15th in Myrtle Beach, surrounding Withers Swash. The program will include a shuttle tour of Withers Swash Watershed and will include education around a variety of water quality research projects occurring in this basin. The program aims to increase municipal staff and community leaders understanding of the hydrologic connections and land use in the watershed, in addition to the scientific research, stormwater management, and planning endeavors that are being pursued to understand and identify pollution sources and potentially reduce water quality impairment in the nearshore coastal waters. This holistic education approach was a recommendation from the City of Myrtle Beach staff who desired a program that would convey the scope of water quality research occurring in the watershed and their linkages to local decision making. The NERRS Science Collaborative Project and hypoxia in Long Bay will serve as a key component of the program. The goal of the tour will be to bring together multiple jurisdictions and resource managers to discuss the hydrology of the watershed, water quality concerns, and how the NERRS Science Collaborative Project and other projects hope to inform future decision-making.

Engagement to date has not brought about any unanticipated challenges, but rather has helped to refine sampling design by recognizing the importance of further data collection in the present study swashes. The engagement has encouraged us to broaden the Watershed Tour focus in Withers Swash. The engagement of the intended users has also informed the project team of the varying education and training needs of the local communities. In particular, it has confirmed the need for continued science-based trainings in the region, especially those that foster shared learning experiences and community collaboration.

C. Progress on project objectives for this reporting period:

The following five key project objectives were identified for the project: 1) Work with intended users to define and develop a categorization scheme for all 14 swashes and select 4 swashes for intensive investigation during the proposed study; 2) Quantify concentrations and forms of nutrient and organic matter entering swashes via surface water and groundwater inputs; 3) Determine internal conditions and processes affecting organic matter transport and

transformations in swashes; 4) Quantify the form and net tidal export of nutrients and organic matter from swashes; 5) Engage intended users to enable use of data to collaboratively develop science-based cost-effective management strategies.

The first objective was accomplished as proposed for this reporting period. The project team (researchers and intended users) met during this reporting period to determine the second set of swashes to sample, or to collectively elect to continue sampling the present two swashes (as stipulated during previous workshops with researchers and intended users). The workshop has been described above under the working with intended users heading.

The second, third and fourth objectives are all related to sampling the inputs, internal processes and outputs from the swashes. Through the end of the current reporting period, a total of 21 sampling events have been conducted between the two study swashes (Table 1). Estimates of water discharge (via ADCP measurements in Withers and water level over spillway in Dogwood) and swash water temperature, conductivity, dissolved oxygen, turbidity and chlorophyll fluorescence (via YSI sonde deployment) have been made semi-continuously throughout this period. On each sampling event, grab samples were collected (via ISCO automated samplers) for concentrations of nitrogen and phosphorus (in all forms), dissolved organic carbon, particulate organic carbon, total suspended sediments, and chlorophyll *a* were made in surface waters of each of the upstream sampling stations as well as in the main swash body. On each sampling event, ground water samples were collected for concentrations of dissolved nitrogen and phosphorus (in all forms), and dissolved organic carbon, at each of the upstream sampling stations as well as at the main swash body discharge site. Nearly continuous measurements of Rn-222 were made in surface waters at both the Withers and Dogwood swash mouth sites, while discrete grab-samples for Rn-222 were collected from groundwater wells at mouth and each upstream site during dry and wet sampling events. In addition, weekly grab sample of surface waters for Rn-222 at each upstream site were collected. Measurements of water column primary production and community respiration were also made in the main swash body. Rainfall amounts and storm hydrographs were collected at each of the upstream events during each rain event sampling. Analytical processing for all of the above sampling is currently in progress. In addition, water samples for the determination of Enterococci most probable numbers were also collected at each site for each sampling event, as part of our continued partnership with the Oceans and Human Health Initiative (OHHI) at NOAA's Hollings Marine Laboratory (as described in previous progress report).

Periods of lack of rain, as well as more recent periods of frequent intermittent rain (violating the no antecedent rain for 72h requirement for dry event sampling) continue to be a logistic challenge and have resulted in prolonged deployment periods in some cases.

During the reporting period we had a number of unanticipated equipment problems. The most problematic and costly were: Debris from a heavy rainstorm caught on the cable to the ADCP in Withers Swash, destroying the cable and causing damage to the ADCP bulkhead, which resulted in a loss of data for a period of time until a second ADCP, borrowed from another project, could temporarily be deployed while the project's ADCP is being returned to the manufacturer for repair; The cable to one of the ISCO flow meters was accidentally cut by a lawn maintenance crew, resulting in loss of data and requiring a new cable to be purchased.

The fifth objective is a continuing process which will evolve throughout the project. The interactions discussed above with the Intended Users and other audiences are all important steps toward this objective.

Plans for meeting project objectives for the next six months include: continuing to sample the two swashes, process samples; conducting various outreach activities.

D. Benefit to NERRS and NOAA: None during the current reporting period.

E. Other: Denise Sanger, Integration Co-lead, has left her previous position at SC Sea Grant to become an Associate Marine Scientist at the SC Department of Natural Resources' Marine Resources Research Institute. Dr. Sanger will continue to serve in her current capacity on this project and both Institutions will now be involved in the Integration component of this project. Leigha Peterson, a Master student at Coastal Carolina University, has joined the project to assist with the groundwater hydrology component and groundwater data from this project will in part form the basis of her thesis. She is being supported in part by project funds (CCU subaward) originally allocated for CCU research technician time.

Table 1. Sampling events for each swash by type of event through the current reporting period.

SWASH	Event Type	Event Dates	Event #
Withers	Dry	July 7-8, 2011	1
Withers	Rain	July 24-25, 2011	2
Dogwood	Rain	August 13-14, 2011	3
Dogwood	Dry	September 13-14, 2011	4
Withers	Dry	October 4-5, 2011	5
Withers	Rain	October 10-11, 2011	6
Dogwood	Rain	November 16-17, 2011	7
Dogwood	Dry	December 11-12, 2011	8
Withers	Dry	January 2-3, 2012	9
Withers	Rain	January 11-12, 2012	10
Dogwood	Dry	Jan. 31, 2012-Feb. 1, 2012	11
Dogwood	Rain	February 18-19, 2012	12
Withers	Rain	March 24-25, 201	13
Withers	Dry	April 11-12, 2012	14
Dogwood	Dry	May 1-2, 2012	15
Dogwood	Rain	May 9-10, 2012	16
Withers	Rain	May 30-31, 2012	17
Withers	Dry	June 25-26, 2012	18
Dogwood	Dry	July 16-17, 2012	19
Dogwood	Rain	August 7-8, 2012	20
Withers	Rain	August 28-29, 2012	21